Amendments to the Claims

The listing of claims below is intended to replace all prior listings of claims presented in the above-identified application.

1. (Currently amended) A biological sensor comprising:

a porous semiconductor structure comprising a central layer interposed between upper and lower layers, each of the upper and lower layers including strata of alternating porosity, and the central layer having a porosity of about 50 to about 90 percent; and

one or more probes coupled to the porous semiconductor structure, the one or more probes being able to bind to a target molecule, whereby a detectable change occurs in a refractive index of the biological sensor upon binding of the one or more probes to the target molecule.

2. (Cancelled)

3. (Previously Presented) The biological sensor according to claim 2 wherein the central layer has a porosity of about 65 to about 85 percent.

4. (Original) The biological sensor according to claim 1 wherein each of the upper and lower layers comprise six or more strata of alternating porosity.

5. (Original) The biological sensor according to claim 1 wherein the strata of alternating porosity comprise first stratum having a porosity of about 35 to about 70 percent and second stratum having a porosity greater than the porosity of the first stratum.

6. (Original) The biological sensor according to claim 1 wherein the porous semiconductor structure comprises pores with an average pore size of between about 2 nm to about 2000 nm.

7. (Original) The biological sensor according to claim 1 wherein the porous semiconductor structure comprises pores with an average pore size of between about 10 nm to about 100 nm.

8. (Original) The biological sensor according to claim 1 wherein the probe is a non-polymeric small molecule selected from the group consisting of avidin, peptido-mimetic compounds, and vancomycin.

9. (Original) The biological sensor according to claim 1 wherein the probe is a tetratryptophan *ter*-cyclopentane which binds to lipopolysaccharide.

10. (Previously Presented) The biological sensor according to claim 1 wherein the probe is a polypeptide selected from the group consisting of a receptor for cell surface molecule, a lipid A receptor, an antibody or fragment thereof, a peptide monobody, a lipopolysaccharide-binding polypeptide, a peptidoglycan-binding polypeptide, a carbohydrate-binding polypeptide, a phosphate-binding polypeptide, a nucleic acid-binding polypeptide, and a polypeptide which binds an organic warfare agent.

11. (Original) The biological sensor according to claim 1 wherein the probe is a nucleic acid molecule.

12. (Original) The biological sensor according to claim 1 further comprising:

one or more coupling agents each comprising a first moiety attached to the porous semiconductor structure and a second moiety which binds to the probe.

13. (Original) The biological sensor according to claim 12 wherein the one or more coupling agents are silanes.

14. (Original) The biological sensor according to claim 13 wherein the silanes are selected from the group consisting of 3-glycidoxypropyltrialkoxysilanes with C1-6 alkoxy groups, trialkoxy(oxiranylalkyl)silanes with C2-12 alkyl groups and C1-6 alkoxy groups, 2-(1,2-epoxycyclohexyl)ethyltrialkoxysilane with C1-6 alkoxy groups, 3-butenyl trialkoxysilanes with C1-6 alkoxy groups, alkenyltrialkoxysilanes with C2-12 alkenyl groups and C1-6 alkoxy groups, tris[(1-methylethenyl)oxy]3-oxiranylalkyl silanes with C2-12 alkyl groups, [5-(3,3-dimethyloxiranyl)-3-methyl-2-pentenyl]trialkoxysilane with C1-6 alkoxy groups, (2,3-oxiranediyldi-2,1-ethanediyl)bis-triethoxysilane, trialkoxy[2-(3-methyloxiranyl)alkyl]silane with C1-6 alkoxy groups and C2-12 alkyl groups, trimethoxy[2-[3-(17,17,17-trifluoroheptadecyl)oxiranyl]ethyl]silane, tributoxy[3-[3-(chloromethyl)oxiranyl]-2-methylpropyl]silane, and combinations thereof.

15. (Original) The biological sensor according to claim 12 wherein each of the one or more probes comprises a plurality of binding sites, at least one of which binds to the target and at least one of which is bonded to the second moiety of the coupling agent.

16. (Original) The biological sensor according to claim 15 wherein the plurality of binding sites on the probe are the same, the biological sensor further comprising:

a plurality of blocking agents, each bonded to the second moiety of the coupling agent under conditions effective to preclude all of the plurality of binding sites on a single probe from binding to the second moieties on the one or more coupling agents.

17. (Original) The biological sensor according to claim 16 wherein the plurality of blocking agents are amino acid alkyl esters.

18. (Original) The biological sensor according to claim 1 wherein the one or more probes are the same.

19. (Original) The biological sensor according to claim 1 wherein the one or more probes are coupled to the porous semiconductor structure throughout the central layer and the upper and lower layers.

20. (Original) The biological sensor according to claim 1 wherein the one or more probes comprises two or more probes which are different, each binding to different target molecules.

21. (Currently amended) The biological sensor according to claim ~~19~~ 20 wherein the porous semiconductor structure includes at least two zones, one of the two or more probes being bonded to the porous semiconductor structure within a first zone and another of the two or more probes being bonded to the porous semiconductor structure within a second zone.

22-33 (Canceled)

34. (Original) A detection device comprising:

a biological sensor according to claim 1;

a source of illumination positioned to illuminate the biological sensor; and

a detector positioned to capture photoluminescent emissions from the biological sensor and to detect changes in photoluminescent emissions from the biological sensor.

35. (Withdrawn) A method of detecting a target molecule comprising:

exposing a biological sensor according to claim 1 to a sample under conditions effective to allow binding of a target molecule in the sample to the one or more probes of the biological sensor; and

determining whether the biological sensor emits a photoluminescent emission pattern which shifts following said exposing, whereby a shifted photoluminescent emission pattern indicates the presence of the target molecule in the sample.

36. (Withdrawn) The method according to claim 35 wherein said determining comprises:

measuring a first photoluminescent emission pattern prior to said exposing;

measuring a second photoluminescent emission pattern after said exposing; and

comparing the first and second photoluminescent emission patterns.

37. (Withdrawn) The method according to claim 35 wherein said measuring is carried out using a light source and a spectral analyzer.

38. (Withdrawn) The method according to claim 35 wherein the target molecule is a protein, glycoprotein, peptidoglycan, carbohydrate, lipoprotein, lipoteichoic acid, lipid A, phosphate, nucleic acid, or organic compound.

39. (Withdrawn) A method of detecting the presence of Gram negative bacteria in a sample comprising:

exposing a sample to a biological sensor according to claim 1 wherein the one or more probes bind to lipid A or fragments thereof; and

determining whether the biological sensor emits a photoluminescent emission pattern which shifts following said exposing, whereby a shifted photoluminescent emission pattern indicates the presence of lipid A and, thus, Gram negative bacteria in the sample.

40-45 (Cancelled)

46. (Previously Presented) The biological sensor according to claim 1 wherein the central layer is a microcavity and each of the upper and lower layers is a Bragg reflector.

47. (Previously Presented) The biological sensor according to claim 1 wherein strata of alternating porosity comprise strata of alternating higher and lower relative porosity.

48. (canceled)

49. (New) A biological sensor comprising:

a porous semiconductor structure comprising a central layer interposed between upper and lower layers, each of the upper and lower layers including six or more strata of alternating porosity; and

one or more probes coupled to the porous semiconductor structure, the one or more probes being able to bind to a target molecule, whereby a detectable change occurs in a refractive index of the biological sensor upon binding of the one or more probes to the target molecule.

50. (New) A detection device comprising:

a biological sensor according to claim 49;

a source of illumination positioned to illuminate the biological sensor; and

a detector positioned to capture photoluminescent emissions from the biological sensor and to detect changes in photoluminescent emissions from the biological sensor.

51. (New) A method of detecting a target molecule comprising:

exposing a biological sensor according to claim 49 to a sample under conditions effective to allow binding of a target molecule in the sample to the one or more probes of the biological sensor; and

determining whether the biological sensor emits a photoluminescent emission pattern which shifts following said exposing, whereby a shifted photoluminescent emission pattern indicates the presence of the target molecule in the sample.

52. (New) A biological sensor comprising:

a porous semiconductor structure comprising a central layer interposed between upper and lower layers, each of the upper and lower layers including strata of alternating porosity; and

one or more probes coupled to the porous semiconductor structure throughout the central layer and the upper and lower layers, the one or more probes being able to bind to a target molecule, whereby a detectable change occurs in a refractive index of the biological sensor upon binding of the one or more probes to the target molecule.

53. (New) A detection device comprising:

a biological sensor according to claim 52;

a source of illumination positioned to illuminate the biological sensor; and

a detector positioned to capture photoluminescent emissions from the biological sensor and to detect changes in photoluminescent emissions from the biological sensor.

54. (New) A method of detecting a target molecule comprising:

exposing a biological sensor according to claim 52 to a sample under conditions effective to allow binding of a target molecule in the sample to the one or more probes of the biological sensor; and

determining whether the biological sensor emits a photoluminescent emission pattern which shifts following said exposing, whereby a shifted photoluminescent emission pattern indicates the presence of the target molecule in the sample.